Dual Purpose Cable for FMPS and SPE Applications

There include two emerging technologies which utilize structured cabling to transmit various levels of both power and data. One is Single Pair Ethernet (SPE) which is a communication technology and the other, Fault Managed Power Systems (FMPS) which is a power delivery technology. Both technologies transmit power safely over single pair cables. Safety is achieved with SPE by limiting the level of voltage and current which can be applied to the cable. FMPS achieves safety by utilizing a much higher level of voltage and current by constantly comparing the amount of power input into the cable and the power received at the end of the cable and quickly shuts the system down if the 2 values don't agree, after accounting for cable losses.
SPE can transmit relatively large amounts of data but only a limited amount of power. FMPS can transmit only small amounts of data, (just enough to support the operation of the technology itself), but large amounts of power.

Both applications operate over one single pair of insulated wire. The diameter of the conductor used to construct the insulated wire depends on the amount of power, and/or data being transmitted and the distance over which the power, and/or data needs to be delivered. In other words, some limitations may arise as to the category a cable is rated to versus its current capacity. (i.e. lay length versus copper diameter).

Cables used for SPE are typically Class 2 or 3 cables and have a minimum voltage rating of 300 V. Cables used for FMPS are typically Class 4 type cable and have a minimum voltage rating of 450V.

Cables used for SPE have a specified level of transmission performance spanning a bandwidth of either 1 to 20 MHz, or 1 to 600 MHz, dependent on the SP cable type. Cables used for Class 4 cables, on the other hand, have no documented requirements for transmission performance other than there being a requirement for the 2 conductors of a pair having to be in "close proximity to each other", which provides for some minimal level of transmission performance.

Disclosed is a series of dual-purpose cables which are capable of meeting all of the requirements for both SPE and FMPS applications within certain specified limits of each application, these limitations being based primarily on conductor diameter. The benefit of such cables is that they can be used for both of these technologies, or for any system requiring a combination the power and data handling capacity associated with the cable.

In general, the disclosed cable's dual performance is achieved by utilizing insulated conductors which satisfy the more onerous voltage requirements

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for Class 4 cable, however which are physically constructed and subsequently processed in a manner which enables them to achieve a desired degree of transmission performance such as Category 3, 5, 5e 6 or 6A.

An additional detail of construction relates to the dielectric properties of the insulating materials used to construct the cable. Since the conductors used for class 4 cable generally require somewhat more insulation than Class 2 or Class 3/category type cables to meet the more stringent voltage requirements, some increase in the dielectric constant of the primary conductor insulation, and/or the jacketing material may be needed to off-set the decrease in capacitance and therefore maintain the desired characteristic impedance of 100-ohm, as is required for all Category type cables.

It should be noted that while the above paragraph applies generally to the approach taken for determining material types and dimensions from an electrical perspective, in practice other factors such as burn/smoke and environmental characteristics must also be considered when determining the type and amount of material used.

Details of the design and construction of such a dual-purpose cable based on 23 AWG conductors, which results in a specific maximum capacity for power, reach, and data transmission, for use within certain limits of both SPE and FMPS applications is disclosed within. However, it is understood that cables constructed using other conductor diameters can likewise be designed and constructed yielding differing capacities for use within certain other limits of both SPE and FMPS.

Another variation may combine BASE-T and FMPS technologies. One of the simpler examples might be a cable capable of meeting requirements specified in UL-1400-1 as well as the transmission requirements of Category 3 cabling.